Small animal disease surveillance: gastrointestinal disease and Salmonellosis

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ABSTRACT

- Presentation for gastrointestinal (GI) disease comprised 2.2 per cent of cat, 3.2 per cent of dog, and 2.2 per cent of rabbit consultations, from 1st of April 2016 to 31st of March 2017
- Diarrhoea and vomiting without blood were the most frequently reported GI disease clinical signs (34.4 and 38.9 per cent in cats, and 42.8 and 37.3 per cent in dogs, respectively)
- The mean percentage of samples testing positive for *Salmonella* in dogs was double that in cats (0.82 per cent and 0.41 per cent, respectively), from 1st of January 2011 to 31st of December 2016
- In dogs autumn was associated with a greater proportion of *Salmonella* positive sample submissions; no clear suggestion of seasonal variation in cats was observed
- In both cats and dogs, isolates belonging to *Salmonella enterica* group B serotypes were the most common (68.9 per cent in cats and 55.0 per cent in dogs)

Report summary

This report is the fourth in a series by the Small Animal Veterinary Surveillance Network (SAVSNET) and it analyses one year data, i.e. from 1st of April 2016 to 31st of March 2017. In the first two sections, it focuses on surveillance for gastrointestinal (GI) disease in veterinary practice and on laboratory-confirmed diagnosis of *Salmonella*, which is an etiologic factor for GI disease in cats and dogs. A third section presents a brief update on the temporal trends of three important syndromes in pet animals, i.e. gastrointestinal (GI) disease, pruritus, and respiratory disease. This is followed by an update on salmonellosis in companion animals. The final section aims to summarise some recent developments pertinent to companion animal health, namely idiopathic cutaneous and renal glomerular vasculopathy, palm oil toxicity, babesiosis and flystrike.

In the future, the reports will expand to other syndromes, including skin disease and tumours. As data are collected for longer, the estimates of changes in disease burden will become more refined, allowing more targeted local and national interventions.

Anonymised data can be accessed for research by contacting the authors. SAVSNET welcomes feedback on this article.

Key words: small animal, disease surveillance, gastrointestinal disease

Syndromic surveillance of gastrointestinal disease

Diseases that are associated with infections or allergic reactions in the gastrointestinal tract are major causes of morbidity in pet animals. GI disease in pet animals may range from acute life-threatening, to mild acute self-limiting, and chronic. GI disorders can lead to dehydration, acid-base and electrolyte imbalances, malnutrition and in some cases death. The present report considers an update of pet animals presented primarily with GI disease to 190 veterinary practices (392 premises) over a one-year period, i.e., from 1st of April 2016 to 31st of March 2017.

All data for this report were obtained from the Small Animal Veterinary Surveillance Network (SAVSNET). A detailed description of the methods used by SAVSNET to capture electronic health records (EHRs) was provided by Sánchez-Vizcaíno and others (Sánchez-Vizcaíno and others 2015). In total, EHRs for 1,486,798 consultations were collected (including repeat consultations for the same animal), of which 65.4 per cent were from dogs, 26.2 per cent were from cats, 1.4 per cent were from rabbits, and the remaining 7 per cent were from other species, or where the species was not noted. Presentation with GI disease, as indicated by the veterinary surgeon’s categorisation, comprised 2.2 per cent, 3.2 per cent, and 2.2 per cent of cat, dog and rabbit consultations, respectively.

Short questionnaires (Sánchez-Vizcaíno and others 2015) were completed for 9,221 animal based on a questionnaire randomly assigned to a proportion of patients presenting primarily with GI disease. Most patients presented with mild GI clinical signs (77.9 per cent of cats, and 80.5 per cent of dogs) after a history of illness of up to two days (38.3 per cent cats, 53.6 per cent dogs). The most common presenting signs in both species were diarrhoea and/ or vomit, in both cases without blood (Table 1). Among diagnostic tests, haematological/ biochemical analyses were the most common (12.3 per cent of cats, and 8.3 per cent of dogs), followed by parasitological or bacteriological analyses on faeces (6.5 per cent of cats, and 7.5 per cent of dogs). A change of diet was recommended in 47.8 per cent of cats, and 59.1 per cent of dogs. These findings were broadly consistent with SAVSNET's last review of GI disease ((Sánchez-Vizcaíno and others 2015).

The spatial distribution of the relative risk for GI disease was evaluated in dogs and cats in England and Wales for each season of the surveillance period (Figure 1). Estimates for Scotland and Northern Ireland were not ascertained because SAVSNET geographical coverage in these areas is currently limited. Animals were considered as 'cases' if, during the season assessed, they presented with GI disease at least once. A kernel smoothing method was used to smooth the spatial variation of the relative risk for GI disease throughout England and Wales. The relative risk of being presented with GI disease was estimated as the ratio of kernel-smoothed intensities (i.e., mean number of events estimated per unit area) of animals presented with GI disease (cases) compared with all animals presented to SAVSNET veterinary practices for a cause other than GI disease (controls). Estimations were made using a grid cell of 5 km and a bandwidth of 50 km ((Sánchez-Vizcaíno and others 2015).

In dogs, many zones of increased relative risk were identified. Most areas appeared transient, although areas around the north and west of Greater London seemed to have a higher relative risk throughout the year (Figure 1). In contrast, the picture in cats appeared more stable, with lower numbers of zones at high relative risk for GI disease compared with dogs, with winter having no zones of high relative risk. Overall, the spatial pattern of the relative risk observed in 2016 and 2017 did not differ from the pattern reported in 2014 and 2015 (Sánchez-Vizcaíno and others, 2015). Together these data reaffirm the different pattern of presentation for GI disease, and suggest that the relative risk for GI disease varies spatially and temporally particularly in dogs. However, it should be noted these zones may not equate to outbreaks; SAVSNET is currently developing models to allow outbreaks to be identified.

Laboratory-based surveillance of *Salmonella* species in small animals in the UK

SAVSNET data gathered from three participating UK-based laboratories between January 2011 and December 2016 were used to identify temporal trends in the proportion of sample submissions of dog or cat origin that either isolated *Salmonella* species in culture or returned a positive result following a PCR-based assay. In total there were 160,427 dog and 51,256 cat sample submissions for either selective culture and / or PCR assay.

Overall, *Salmonella* species were identified in 0.82 per cent (95 per cent confidence interval, CI, 0.77-0.86) and 0.41 per cent (CI 0.36-0.47) of canine and feline sample submissions, respectively. In dogs the greatest percentage of positive *Salmonella* species sample submissions occurred in 2013 (1.00 per cent, CI 0.88-1.11). In cats the greatest percentage also occurred in 2013 (0.49 per cent, 0.35-0.63) along with 2016 (0.49 per cent, 0.34-0.63).

In dogs, autumn was associated with a greater proportion of positive sample submissions (0.98 per cent, 0.89-1.08) than winter (0.75 per cent, 0.66-0.83), spring (0.76 per cent, 0.67-0.85) or summer (0.76 per cent, 0.68-0.85). This observation was not repeated in cats, with *Salmonella* identification frequency being broadly comparative across all seasons (autumn: 0.42 per cent, 0.32-0.52; winter: 0.44 per cent, 0.32-0.56; spring: 0.37 per cent, 0.25-0.49; summer: 0.40 per cent, 0.29-0.51). A full month-by-month summary can be observed in Figure 2.

Salmonella was described beyond simple presence in 65.5 per cent (n=860) of positive canine sample submissions and 51.4 per cent (n=108) of positive feline sample submissions. All isolates were found to belong to the *Salmonella enterica* species, with 855 (99.4 per cent) of canine isolates belonging to the *enterica* sub-species (three *diarizonae*, and two *arizonae*). In cats, 106 (98.1 per cent) of isolates belonged to the *enterica* sub-species; with one isolate each of *diarizonae* and *arizonae*. Further characterisation of isolates identified as *Salmonella enterica* subspecies *enterica* was variable, with 854 canine and 106 feline isolates characterised to serogroup, but only a small portion (n=15 in dogs, n=4 in cats) characterised to serotype (Table 2); as in previous studies, the most frequently recorded serogroup was group B in both dogs and cats (Philbey and others 2014).

These findings demonstrate that infection of dogs and cats with *Salmonella* species (whether clinical or sub-clinical) should continue to be recognised as a public health risk in the UK. In order to better understand the importance of *Salmonella* as a zoonotic pathogen, further epidemiological comparisons between human and companion animal reports, including more complete serotyping, sequencing and antimicrobial susceptibility patterns would be warranted.

Update on the temporal trends of the main syndromes in companion animals

This report briefly describes the temporal trends from the syndromic surveillance for GI, pruritus and respiratory disease, between 1st of April 2014 and 31st of March 2017. Figure 3 shows the mean consultation rate for each of the syndromes aggregated per week and species (i.e., cats and dogs).

During our evaluation period, GI disease was reported slightly more in dogs (41.5 consultations per 1,000), compared to cats (30 consultations per 1,000). A higher rate of consultations for GI disease in cats and dogs were observed in November and December 2014 and 2015 (more than 40 consultations per 1,000).

Throughout the entire evaluation period, pruritus was reported more in dogs (68 consultations per 1,000) compared to cats (38 consultations per 1,000). Overall, cats and dogs had a higher rate of consultations for pruritus in the wormer months of the year; for dogs this peak rising from May to October and in cats from June to September (Fig 3).

In contrast to the other syndromes, respiratory disease was reported slightly more in cats (20.2 consultations per 1,000), compared to dogs (14.8 consultations per 1,000). The trend of respiratory disease in both cats and dogs was more stable throughout all months of our evaluated period (Fig 3). However, a slight increase rate of consultations in cats was observed were observed in May and June and in dogs from September to November, and especially in 2014 and 2015.

As discussed in our previous reports (Sánchez-Vizcaíno and others 2016a), the overall consultation rates for GI, pruritus and respiratory disease, are decreasing from year to year. Whether this represents a true change in disease, a change in the surveyed population characteristics as SAVSNET grows, or in how veterinary surgeons are reporting disease to SAVSNET needs to be determined.

Update on Salmonellosis in companion animals

The bacteria. *Salmonella* species are a group of bacteria of importance to animal and public health, due to the zoonotic potential of the non-typhoidal serotypes, whose primary hosts are domestic and wild animals. Humans usually become infected by eating poorly cooked, contaminated food or via close direct or indirect contact with asymptomatic carriers or reservoirs (CFSPH 2017; PHAC 2017). In pets, the majority of *Salmonella* reports are serotypes of *Salmonella enterica* subspecies *enterica* (*S.* Typhimurium*, S.* Dublin*, S.* Enteritidis, etc.). Major sources of infection are ingestion of faecal-contaminated raw meat and offal (Philbey and others 2008, 2014).

Clinical signs and carriers. Dogs and cats generally exhibit sub-clinical *Salmonella* infection; if clinical disease does occur, it is often characterised by severe diarrhoea, vomiting, fever and lethargy (Jacob and Lorber 2015). Young animals and aged or debilitated dogs and cats are most susceptible (Carter and Quinn 2000). Pet reptiles (e.g., lizards, snakes, and turtles) and amphibians (e.g. frogs, toads, newts, and salamanders) are considered as reservoirs, shedding bacteria intermittently or continuously in their faeces. Point prevalence studies report carriage rates in these animals as high as 94% (Mermin and others 2004).

Since reptiles are kept more commonly, there has been an increase in reptile-associated *Salmonella* infections in humans. A well-documented example is the single-source outbreak of *S.* Enteritidis PT 8, genotype 2-10-8-5-2, which has been ongoing since 2011 in the UK, with additional cases in the Netherlands, Denmark and Norway. Human cases were associated with exposure to pet reptiles, and the so-called “feeder-mice” used to feed different species of reptiles and birds of prey (ECDC 2016). From 2012 to 2016, 275 human cases were identified across the UK, 40% of them in children below 10 years of age, many reporting close contact to reptiles, particularly corn snakes. A case in Scotland reported being exposed to a bird of prey (ECDC 2016).

Diagnosis. Diagnosing salmonellosis in pet animals requires testing a clinical specimen (such as stool or blood) to distinguish it from other illnesses that can cause diarrhoea and fever. Diagnosis can be confirmed by isolation of the organism, often via selective culture protocols and, more recently, polymerase chain reaction (PCR) assays. Sequencing is now used in outbreak investigations to link cases of illness with similar bacteria and track them to the source (example: a contaminated food or an infected animal).

Treatment. The treatment of clinical salmonellosis in dogs and cats depends on the severity of the infection. Treatment may include rehydration, and replacing lost electrolytes; in severe cases, plasma or blood transfusions may be necessary, along with glucocorticoids to prevent shock. Use of antibiotics is more controversial. Although antibiotics often improve symptoms, their use can prolong the carrier state and in some cases worsen the condition if the *Salmonella* strain is highly resistant to the antibiotic used. There is also a risk of selecting for antibiotic resistance. Therefore, antibiotics should only be used where disease is considered severe. In such cases a faecal sample should be taken before treatment for diagnosis and antimicrobial susceptibility testing, even if treatment has to be started before the result is available (Carter and Quinn 2000).

Because of the possibility of prolonged carriage of *Salmonella*, it is recommended to take a further sample after 2-3 weeks and, if positive, a further sample. If there is very prolonged carriage of *Salmonella*, a long course of a suitable systemically active antibiotic to which the strain is sensitive could be considered on public health grounds in some circumstances, e.g. for care dogs. After such treatment it is usual to test three further faecal samples 1-2 weeks apart to confirm successful clearance of infection.

There is no efficient treatment for reptile or amphibian carriers; once they become carriers, they will most likely remain as such. Keeping these pets healthy and free of stress can reduce the probability of shedding the bacteria.

Control. Raw meat pet foods represent a potential source of *Salmonella* to both the animals eating them and the humans handling the food. If they are used, a cold chain should be maintained from purchase to consumption. Young children or immunocompromised persons should not handle raw meat pet food or feeding equipment. Raw meat pet food should not be stored with human food, and should be kept in a clean leak-proof container. Any raw pet food that is not immediately eaten should be discarded to avoid multiplication of bacteria. Feeding bowls and equipment (e.g. knives, spoons, cutting boards, and cloths) should be distinct from those used for human food, washed with kitchen detergent and hot water thoroughly after use and, if possible, not in the same sink as is used for human crockery. Areas used for preparing raw meat pet food and utensils should be thoroughly cleaned and disinfected after use. Special attention should be given to safe disposal of faeces from dogs that are fed on raw pet foods and to personal hygiene after handling such animals.

Reptile owners should follow basic hygiene procedures, such as thorough washing of hands with soap and water after handling and feeding the animals, or cleaning their cages. Additionally, reptiles should be kept away from rooms where food is prepared and eaten, as well as limiting free roaming in the house. All surfaces for cleaning or bathing animals should be well cleaned and disinfected after use (ECDC 2016).

Active and passive surveillance data on the occurrence of salmonellosis in animals in the UK is available through disease reports produced by the Animal Health and Veterinary Laboratories Agency and Animal and Plant Health Agency (AHVLA, APHA 2014). Updated information on human outbreaks of *Salmonella* in the UK is available from the web pages of Public Health England (PHE 2017), and the Centre for Disease Control and Prevention for outbreaks in the European Union (ECDC 2017).

Unlike in food animals, salmonella is not reportable in companion animals. However, practitioners with positive cases are encouraged to contact APHA, so important isolates are serotyped, antimicrobial resistance (AMR) tested and data registered centrally for surveillance purposes.

Global perspective

This section of the small animal surveillance report briefly reviews some topical global trends in companion animal infection.

Idiopathic Cutaneous and Renal Glomerular Vasculopathy. Practitioners and owners are again being reminded to look out for idiopathic cutaneous and renal glomerular vasculopathy (also known as Alabama rot). Eleven new confirmed cases in 2017 are proof, if proof was needed, that this rare but serious canine disease is still active. Most cases are seen in the winter and spring. The most consistent lesion is that of a skin sore that is not associated with any known previous injury. The majority of affected dogs deteriorate rapidly with common signs including anorexia, vomiting, lethargy, and less consistently icterus, diarrhoea, abnormal bleeding and seizures. Dogs can be affected across Great Britain, and a case has now been reported in Ireland. The cause of CRGV remains unknown. More information is available at http://www.andersonmoores.com.

Palm oil toxicity. Owners and those in veterinary practice are being warned about the dangers of a pollutant currently washing up on some of Britain's and Ireland's shores. "Fatbergs" are sometimes large gelatinous masses of congealed palm oils that float across the Atlantic onto Britain's beaches. Dogs are attracted to the smell and taste, and those that consume the oils can die.

Babesia canis. Following the small outbreak of *Babesia canis* originally reported in the Veterinary Record last year in Essex (Swainsbury and others 2016), and subsequently confirmed by data from SAVSNET (Sánchez-Vizcaíno and others 2016b), scientists have confirmed that *Babesia Canis* is established in pockets of its vector *Dermacentor reticulatus* resident primarily in Essex. A further positive tick was identified on the west coast of Wales (de Marco and others 2017). The authors suggest veterinary surgeons, particularly those in affected areas, should remain vigilant for future outbreaks of tick-borne disease in dogs, even in those that may have not travelled overseas. Local control measures seemed to have halted the original Essex outbreak (https://www.liverpool.ac.uk/savsnet/real-time-data/). SAVSNET has recently published a paper showing how data from practitioners can be used to map tick activity across the UK (Tulloch and others 2017).

Seasonal increase of Fly strike. Flystrike – or myiasis – is caused by larvae of *Lucilia sericata* (the green bottle fly) feeding on the surface of the skin. This can cause severe tissue damage that is susceptible to secondary bacterial infections and may result in death of the animal. Using data collected from over 40,000 rabbit consultations, SAVSNET has confirmed that summer and early autumn are the seasonal peaks in fly strike. Practitioners should encourage owners to check their rabbits at least daily to make sure they are healthy, clean and can groom themselves properly (https://www.liverpool.ac.uk/savsnet/news/).

Conclusion

This is the fourth UK Small Animal Disease Surveillance (SADS) report, which highlights the importance of GI disease in UK pet animals, and in particular infection with *Salmonella* due to its zoonotic potential. As we collect data for longer, our estimates of changes in disease burden will become more refined, allowing more targeted local and perhaps national interventions. Anonymised data can be accessed for research by contacting the authors. SAVSNET welcomes your feedback.

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Tables

Table 1: Percentage of clinical signs in 2,079 cats and 7,849 dogs presenting with GI disease to veterinary practices in the UK, from 1st of April 2016 to 31st of March 2017. *

Clinical sign	**Number (%) of cats**	**Number (%) of dogs**
Diarrhoea with blood	256 (12.3)	2,008 (25.6)
Diarrhoea without blood	715 (34.4)	3,363 (42.8)
Melaena	13 (0.6)	79 (1.0)
Vomiting with blood	52 (2.5)	242 (3.1)
Vomiting without blood	808 (38.9)	2,924 (37.3)
Weight loss / failure to gain weight	262 (12.6)	301 (3.8)
Poor appetite	352 (16.9)	1,112 (14.2)

* The same animal could present with more than one clinical sign per consultation

Table 2: Determined serogroups and serotypes (when available) of *Salmonella enterica* subsp. *enterica* from 854 isolates from dogs and 106 isolates from cats between 1st of January 2011 and 31st of December 2016.

Serogroup		**Number (%) of isolates - cats**	**Number (%) of isolates - dogs**
S.enterica Group B		73 (68.9)	471 (55.0)
S.enterica Group C		18 (17.0)	258 (30.1)
S.enterica Group D		15 (14.2)	125 (14.6)
Unknown		0	2 (0.2)
Serogroup	**Serotype**	**Number of isolates - cats**	**Number of isolates - dogs**
B	Kentucky	0	1
B	Stanley	0	1
B	Typhimurium	2	2
C	Bareilly	0	2
C	Bovismorbificans	0	1
C	Carno	0	1
C	Kottbus	0	1
C	Montevideo	0	1
C	Thompson	1	0
D	Dublin	0	3
D	Enteritidis	1	0
Unknown	i: 4-5-12	0	2

Figures

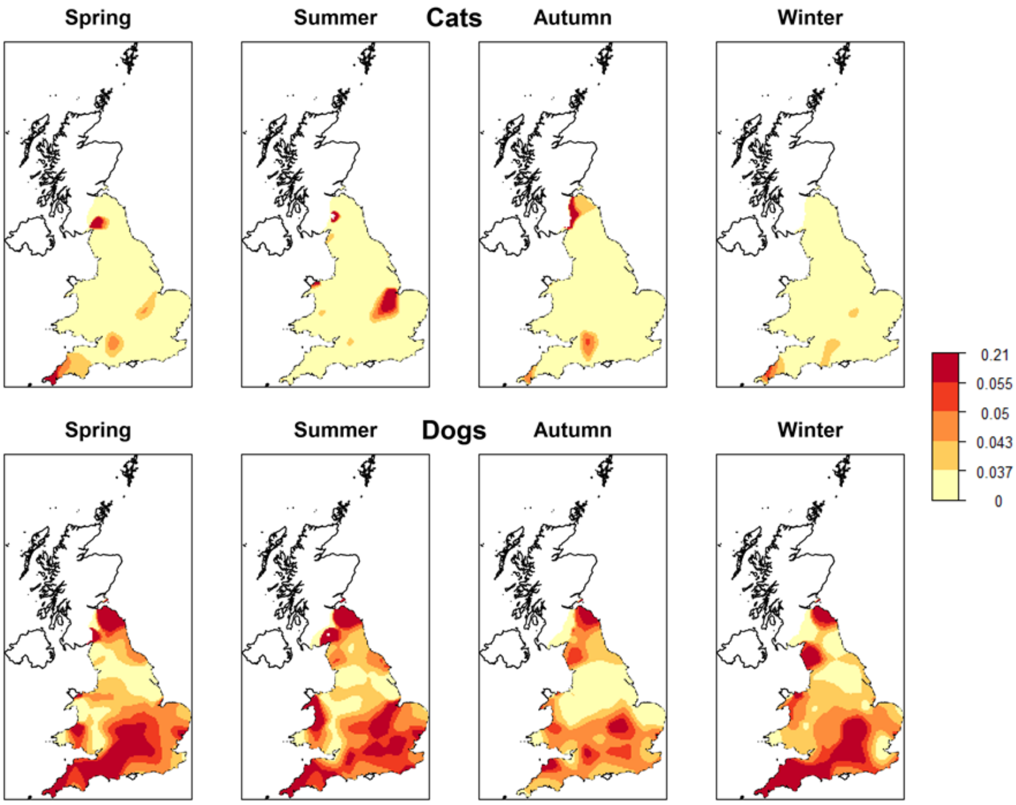

FIG 1: Kernel intensity ratio surface of England and Wales showing the relative risk of cats and dogs being presented with gastrointestinal (GI) disease by season from 1st of April 2016 to 31st of March 2017. The colours for relative risk have been categorised using the four cut-offs that divide the results obtained from dogs during summer into five equal-size groups (quintiles) each containing 20 per cent of all results.

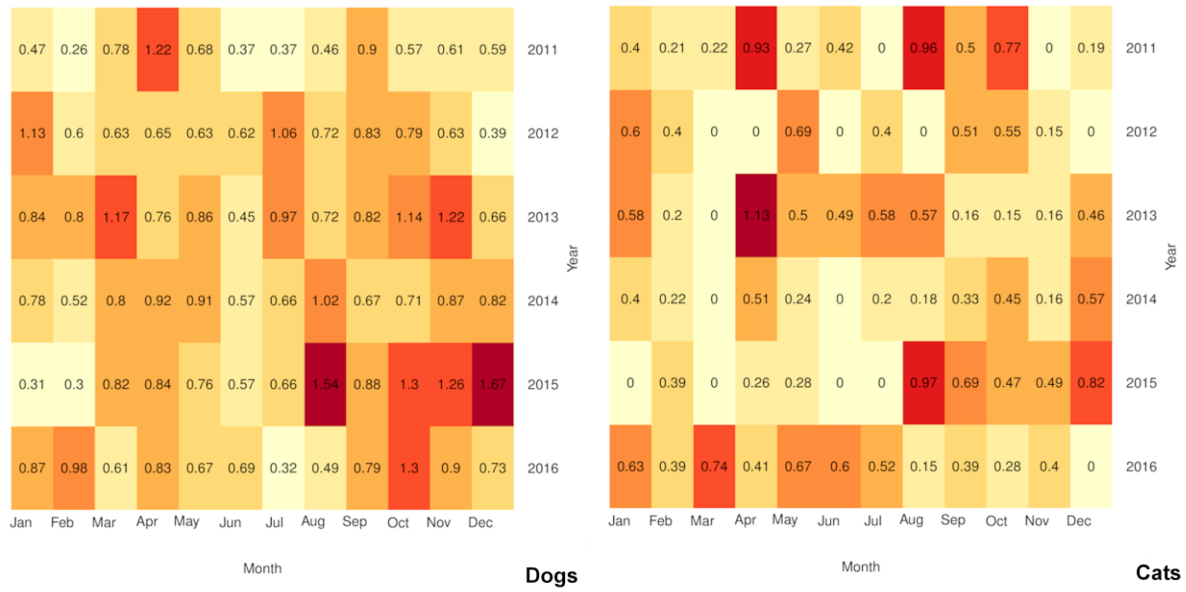

FIG 2: Percentage of sample submissions testing positive for Salmonella from January 2011 to December 2016. Results are aggregated by month and species.

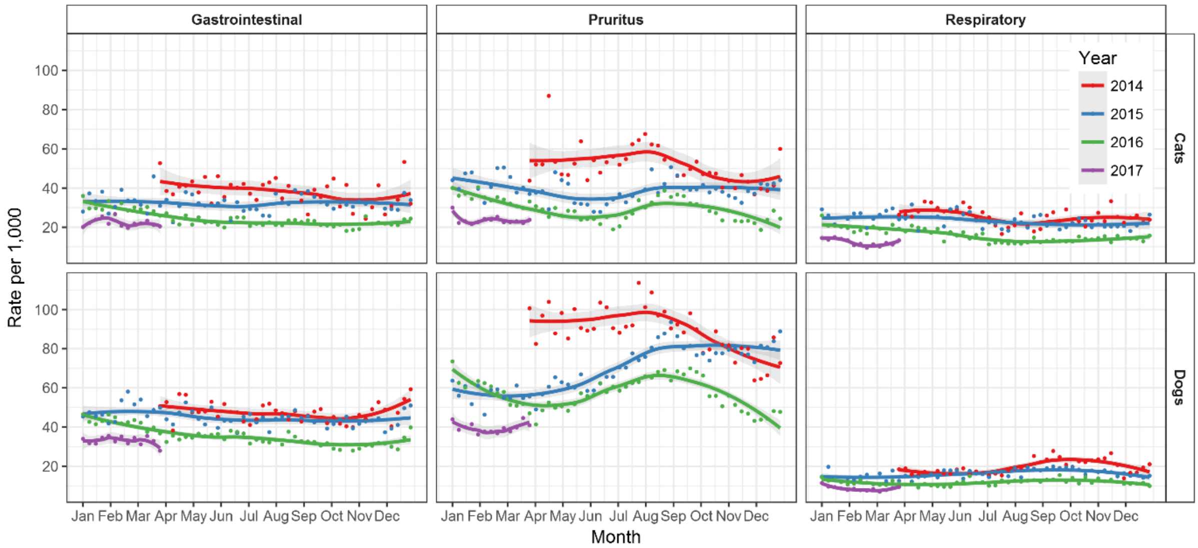

FIG 3: Monthly consultation rate for gastrointestinal, pruritus and respiratory disease in a UK veterinary-visiting population of cats and dogs, between 1st of April 2014 and 31st of March 2017. The shaded areas around the solid lines depict a smoothing 95% Confidence Intervals of the weekly values by a locally weighted regression (Cleveland and Devlin 1988).